DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/17/2009 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 5-7 and 9, are rejected under 35 U.S.C. 103(a) as being unpatentable over Namiki et al. (USP-4,382,389) in view of Umeyama et al. (USP-6,080,199) further in view of Imase et al (USP-6,02.,989).

Re clm 5: Namiki discloses a rack-and-pinion steering apparatus (Figs. 6 and 7) including pinion teeth (67) provided on a circumferential surface of a pinion shaft (65) and rack teeth (66) provided on an outer surface of a rack shaft (63), meshed with each other substantially without backlash (via 68), so as to transmit rotation of the pinion shaft connected to a steering member (61) to the rack shaft via a mesh portion between

the pinion teeth and the rack teeth (Figs. 6 and 7), thus to move the rack shaft in an axial direction thereof at a predetermined stroke ratio for execution of steering operation.

Regarding the limitation, "wherein the pinion teeth are provided with a module m, a number of teeth z, a tooth depth h and a helix angle β that remain within the following respective ranges, under a condition of a pressure angle α being within a range of 24° to 30° and the stroke ratio: module m: 1.8 to 2.0, number of teeth z: 7 to 13, tooth depth h: 2m to 2.5m, helix angle β:40° or smaller " Namiki discloses the claimed invention except for identical ranges for the above values. It would have been obvious to a person having ordinary skill in the art at the time the invention was made to have set values for the gear teeth within the respective ranges, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233.

Additionally, while it appears Nakimi does indeed disclose a pressure angle α being within a range of 24° to 30° (C6 L8-13), a number of teeth z: 7-13 (Figs. 6 and 7), and a helix angle β:40° or smaller (C6 L8-13), Nakimi does not explicitly disclose a module m of 1.8-2.0, and a tooth depth h of 2m-2.5m.

Umeyama teaches a method of designing a gear, wherein the gear has a module m of 1.8-2.0, and a tooth depth h of 2m-2.5m (C10 L9-10, C24 L45-49, C27 L61-64) for the purpose of optimizing the gear to reduce transmission error amplitude thus reducing

gear noise (see Abstract and C26 L2-37 explaining optimization of the above parameters).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to have modified the module m and tooth depth of the pinion of Nakimi such that the module m is 1.8-2.0 and the tooth depth h is 2m-2.5, as taught by Umeyama, for the purpose of optimizing the gear to reduce transmission error amplitude thus reducing gear noise (see Abstract and C26 L2-37 explaining optimization of the above parameters).

Additionally, Namiki does not disclose a trochoid interference clearance of the rack teeth and the pinion teeth is positive.

Imase teaches a rack and pinion system (Fig. 1) wherein a trochoid interference clearance of the rack teeth (4) and the pinion teeth (6) is positive (see Figs. 6 and 7 and C5 L64-C6 L14) for the purpose of ensuring proper meshing of the pinion and rack and to reduce gear noise.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to have modified the device of Namiki and Umeyama such that a trochoid interference clearance of the rack teeth and the pinion teeth is positive, as taught by Imase, for the purpose of ensuring proper meshing of the pinion and rack and to reduce gear noise.

Re clms 6 and 7: Nakimi in view of Umeyama disclose all of the claimed subject matter as described above.

Nakimi does not disclose the pinion teeth are subjected to a tooth surface modification such that a difference in pressure angle is provided in a direction of the tooth profile so as to increase a mesh stress with the rack teeth, and that a central portion thereof is formed in a convex shape, and the pinion teeth are subjected to a tooth surface modification of crowning along a tooth trace direction.

Umeyama further teaches pinion teeth are subjected to a tooth surface modification such that a difference in pressure angle is provided in a direction of the tooth profile so as to increase a mesh stress with the rack teeth, and that a central portion thereof is formed in a convex shape, and the pinion teeth are subjected to a tooth surface modification of crowning along a tooth trace direction (Figs. 19, 26-41, C23 L31-C24 L14), for the purpose of optimizing the gear to reduce transmission error amplitude thus reducing gear noise (Abstract, C23 L31-41).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to have modified the tooth surface of the pinion gear of Nakimi suc that the pinion teeth are subjected to a tooth surface modification such that a difference in pressure angle is provided in a direction of the tooth profile so as to increase a mesh stress with the rack teeth, and that a central portion thereof is formed in a convex shape, and the pinion teeth are subjected to a tooth surface modification of

crowning along a tooth trace direction, as taught by Umemyama, for the purpose of optimizing the gear to reduce transmission error amplitude thus reducing gear noise (C23 L31-41).

Re clm 9: Namiki in view of Umeyama and Imase disclose all of the claim limitations as described above.

While Imase does indeed teach a positive interference clearance between the rack and pinion, Imase does not explicitly disclose wherein the trochoid interference clearance is 0.3mm or more.

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to have set the trochoid interference clearance to be 0.3mm or more, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233.

4. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Namiki et al. (USP-4,382,389) in view Umeyama et al. (USP-6,080,199) and Imase et al (USP-6,02.,989) further in view of Nakatsu et al. (USP-6,834,742).

Re clm 8: Nakimi does not disclose a motor for steering assistance is disposed between the steering member and the pinion shaft, thus to constitute an electric power steering apparatus that transmits the rotational force of the motor to the pinion shaft to assist the steering operation executed according to the rotation of the pinion shaft.

Nakatsu teaches a motor (30) disposed between a steering member (2) and a pinion shaft (6), thus to constitute an electric power steering apparatus that transmits the rotational force of the motor to the pinion shaft to assist the steering operation executed according to the rotation of the pinion shaft, for the purpose of achieving the predictable result of providing a steering assist to the driver.

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to have included in the device of Nakimi in view of Umeyama, a motor for steering assistance is disposed between the steering member and the pinion shaft, thus to constitute an electric power steering apparatus that transmits the rotational force of the motor to the pinion shaft to assist the steering operation executed according to the rotation of the pinion shaft, as taught by Nakatsu, for the purpose of achieving the predictable result of providing a steering assist to the driver.

Response to Arguments

5. Applicant's arguments filed 12/17/2009 have been fully considered but they are not persuasive.

In response to applicant's argument that one of ordinary skill in the art would not look to modify Namiki in view of Umeyama because Umeyama discloses a transverse contact ratio of 1.6 or greater, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references

would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

Applicant further argues that the prior art does not identify the number of teeth, the pressure angle, helix angle, tooth depth, and module as result effective variables.

Umeyama describes in column 26 lines 18-29 of the specification under the heading "Novel Method of Designing a Gear", that the design parameters to be taken into account when designing a gear are the tooth number, normal module, tooth depth, pressure angle and helix angle. Additionally, Umeyama discloses in Figs. 9, 21, 22, the relationship of the above parameters and there influence on gear design. Therefore the prior art does indeed identify the number of teeth, the pressure angle, helix angle, tooth depth, and module as result effective variables.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW A. JOHNSON whose telephone number is (571)272-7944. The examiner can normally be reached on Monday - Friday 9:00a.m. - 5:30p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Ridley can be reached on 571-272-6917. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MATTHEW A JOHNSON/
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